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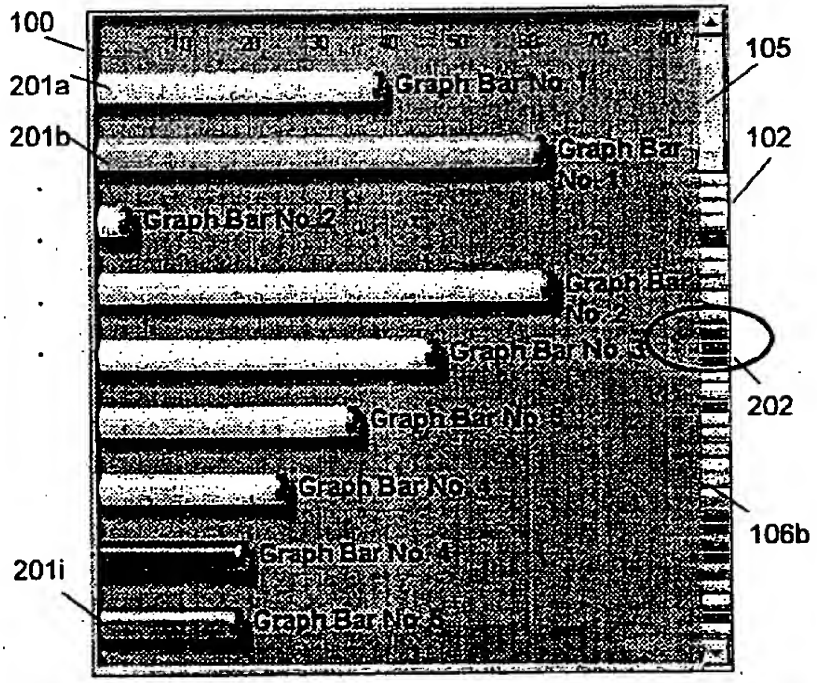
(54) Title: A METHOD FOR RENDERING A VISUAL OVERVIEW OF HIDDEN DATA

(57) Abstract

Method for graphically rendering a preview of a complete set of data to a user, in parallel with a normal view of at least a portion of said data, within the area of a scroll-bar. The data field of the complete set of data is divided into N (N=1, 2, ...) slices. The length of the free area of the scroll-bar is divided into N corresponding segments. The length of each segment is determined according to one or more particular attributes of its corresponding slice. The length of the lift of the scroll-bar is determined to represent the data portion being displayed in a normal view. The graphical representation of each segment is modified by assigning a particular visual characteristic to each segment, which represents the one or more particular attributes. A preview of the remaining portion of the data is generated by displaying each of the N modified segments in the scroll-bar. If desired, the user can vary the content of the normal view by changing the relative position of the lift within the scroll-bar. The length of each segment may be proportional to the ratio between the length of its corresponding slice, and the total length of the complete set of data.



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A METHOD FOR RENDERING A VISUAL OVERVIEW OF HIDDEN DATA

Field of the Invention

The present invention relates to the field of data processing. More particularly, the invention relates to a method and system for rendering comparative visual overview of hidden data, by simultaneously displaying selected portions of the data in a normal view, and other portions, in the unexploited areas of a scroll-bar that is used to control the normal view.

Background of the Invention

Many applications involve displaying data to an interested user by employing visual interaction between the user and the data source. Normally, such interaction is provided through the workstation display of the user, which views data graphically. In most cases, the field of view is limited, and therefore, only a portion of the graphical data is displayed to the user. The user can select a portion of interest and display it on the screen in the normal view (usually, the normal view occupies most of the screen areas. The remaining area is used to provide the user with interaction tools, such as tool-bars and other control symbols). For example, if the data of interest is a page or a paragraph, taken from a document that has been edited by a word processor (e.g., Microsoft Word), at the beginning of editing the document, all the relevant data is fully rendered (i.e., displayed to the user) on screen. As the editing process continues, the document accumulates more and more data (i.e., there is a data "overflow" on screen), until the display area cannot contain all the lines. The user can select any portion to be fully displayed, by scrolling the limits of the field of view over the entire area of the document, by using the "page-up"/"page-down" keys, using the arrow keys or by using the scroll-bar. However, the user can only view a portion of the data, without

obtaining any indication related to the "hidden" portion of the data (i.e., the data that is not currently displayed). Therefore, the user often lacks the ability to obtain a general perspective of the general data while concentrating in a portion of the accumulated data.

This problem is further increased when continuous viewing of accumulated data may be used as an on-line indication related to important stages in a process. Such data is accumulated, for instance while monitoring the electrical activity of a patient's heart by connecting the patient to an electrocardiogram device and continuous collecting data. Diagnosis of the patient condition may be more accurate, and in some cases even critical, when the accumulated data is rendered before treatment is given to the patient. In addition, the rendering of accumulated data provides indications related to different trends, which should be considered before any step is taken.

Conventional methods use zoom-in/zoom-out features to include larger area of visible data inside the field of view, or to focus the view on a particular area. However, these methods do not enable simultaneous view of zoomed-in and zoomed-out data. Other traditional methods render these views simultaneously, on the normal field of view. However, these traditional methods are problematic, since precious screen area is lost.

Another limitation of prior art methods for rendering hidden data arises when the user is interested in a particular data point or data portion. By using prior art methods, the user has to scroll the data portion and to bring it into the field of view (e.g., by pressing the page-up/page down key in his keyboard), or to change the location of the "lift" of the scroll-bar (i.e., the rectangular area in a scroll-bar which is commonly used to navigate within the data by clicking of it and dragging it along the area of the

scroll-bar) within the "dead area". For example, in case when the complete data is a document containing 50 pages, and only one page can be normally displayed, if the user wishes to display a particular section of interest located at page #25, he "drags" the lift approximately to the center of the scroll-bar area. However, the user may not know where this particular section is located within the document, and therefore, has to find the location by trial and error, or alternatively, by linearly scrolling the whole document on the display, until the required section appears on screen. Moreover, if for example, the data field is a business graph showing the total sales along a period and the user is interested in the peak value within this period, he has to seek the peak point by going over the whole graph (i.e., he knows that the desired point is the peak only after going over the entire graph). When the complete data is a picture, a user who wishes to display a segment of the picture only knows the estimated location of the segment in the picture. Therefore, since he does not know which page contains the segment, he cannot accurately reach this segment by simply dragging the scroll-bar, and several trial and error operations are required

Microsoft Word™ (Microsoft corporation, Redmond WA, USA) offers a preview of the more important parts of a text document, such as the headlines, using the "Document Map" option. However, this preview which appears on the left (and has its own scroll-bar) occupies almost one-third of the normal display area, and still does not provide a full coverage of the complete data field.

Microsoft WinDiff™ (Microsoft corporation, Redmond WA, USA) provides to the user a graphical display of a comparison between two files. However, the graphical representation of the differences between the two files also occupies a normal display area, and is not dynamically updated

(i.e., new aggregated differences are not displayed on-line). In addition, there is no dragging option for navigating within the displayed preview.

All the methods described above have not yet provided satisfactory solutions to the problem of simultaneously rendering comparative visual overview of hidden data, together with a selected portion of the data in a normal view, by using unexploited areas of the normal display.

It is an object of the present invention to provide a method and a system for simultaneously rendering comparative visual overview of hidden data, together with a selected portion of the data in a normal view, by using unexploited areas of the normal display, which overcome the drawbacks of the prior art.

It is another object of the present invention to provide a method and a system for simultaneously rendering comparative visual overview of hidden data, together with a selected portion of the data in a normal view, that enable the user to accurately and rapidly select an area of interest from the hidden data portions.

It is a further object of the present invention to provide a method and a system for simultaneously rendering a comparative visual overview of hidden data, together with a selected portion of the data in a normal view, that enable the user to identify particular properties in the hidden data.

It is a still another object of the present invention to provide a method and a system for simultaneously rendering a comparative visual overview of hidden data, together with a selected portion of the data in a normal view, that provides the user easier navigation features within the data.

Other objects and advantages of the invention will become apparent as the description proceeds.

Summary of the Invention

The present invention is directed to a method for graphically rendering a preview of a complete set of data to a user, in parallel with a normal view of at least a portion of said data, within the area of a scroll-bar. The data field of the complete set of data is divided into N (N=1,2,...) slices. The length of the free area of the scroll-bar is divided into N corresponding segments. The length of each segment is determined according to one or more particular attributes of its corresponding slice. The length of the lift of the scroll-bar is determined to represent the data portion being displayed in a normal view. The graphical representation of each segment is modified by assigning a particular visual characteristic to each segment, which represents the one or more particular attributes. A preview of the remaining portion of the data is generated by displaying each of the N modified segments in the scroll-bar. If desired, the user can vary the content of the normal view by changing the relative position of the lift within the scroll-bar. The length of each segment may be proportional to the ratio between the length of its corresponding slice, and the total length of the complete set of data.

A particular attribute may be a relative value represented by the slice, with respect to an extreme value of another slice. Attributes may comprise the color of the slice, the tint of the slice, the pattern of the slice or any combination of them. The particular attribute of the slice may also be a predetermined mapping operation. Particular visual characteristics may also be the color or the tint or the pattern of a segment, or any combination of them. Each slice may represent a minimized or thumbnailed image.

Preferably, the method further comprises continuously updating the number and/or the length and/or the graphical representation of each segment in the scroll-bar, in response to the addition of data into the existing set of data. Data segment is selected from the scroll-bar for display in proximity of the center of the normal view, according to the degree of overlapping between the center of the lift and the segment, or by pointing on the data segment, and clicking a mouse button, or pressing a key in the keyboard associated with the data processing and/or display apparatus. The lift may also comprise a transparent area, through which the previewed data-portion is continuously displayed in any lift position.

The present invention is directed to a scroll-bar for use with a data processing and/or displaying program. The scroll-bar is divided into N segments, corresponding to N slices of a data field associated with the program. Each of the segments is dynamically modifiable in its graphical representation according to one or more particular attribute of the slices.

Brief Description of the Drawings

The above and other characteristics and advantages of the invention will be better understood through the following illustrative and non-limitative detailed description of preferred embodiments thereof, with reference to the appended drawings, wherein:

- Fig. 1A schematically illustrates a conventional prior art display screen with a vertical scroll bar on its right side;
- Fig. 1B schematically illustrates the relationship between the size of different elements of a vertical scroll-bar and a partial and/or the complete data field, in a conventional prior art display screen with a vertical scroll bar on its right side;

- Fig. 2A schematically illustrates the operation of displaying a preview of complete data that is represented by a set of colored bars, by a colored scroll-bar, according to a preferred embodiment of the invention;
- Fig. 2B schematically illustrates the operation of displaying the selection of particular area of interest from a preview of complete data that is represented by a set of colored bars, according to a preferred embodiment of the invention;
- Fig. 3 schematically illustrates the operation of displaying the selection of particular area of interest from a preview of complete data that is represented by a set of colored bars, using calendar lift, according to a preferred embodiment of the invention;
- Fig. 4 schematically illustrates the operation of displaying a preview of minimized data items, contained in the complete data, which are represented by a set of colored bars, according to a preferred embodiment of the invention; and
- Fig. 5 schematically illustrates the operation of displaying a preview of minimized images using a scroll-bar, according to a preferred embodiment of the invention; and
- Fig. 6 schematically illustrates the structure of a scroll-bar containing a preview of hidden data, according to a preferred embodiment of the invention.

Detailed Description of Preferred Embodiments

Fig. 1A schematically illustrates a conventional prior art display screen with a vertical scroll bar on its right side. The screen 100 comprises a normal field of view 101, for rendering data, and a scroll-bar 102, for controlling the data rendered in the normal field of view 101. The scroll-bar 102 comprises up/down arrows 133, and 104, respectively, and a "lift" 105, for selecting a portion of the complete data. The relative location of the selected portion within the complete data is represented by the

relative position of the lift 105 within the area of the scroll-bar (excluding the area occupied by the up/down arrow boxes 133, and 104. The length of the lift 105 is determined by the size (the length) of the field of view 100, with respect to the length of a theoretical field of view, which is required to display the complete data. The scroll-bar area 102 also comprises a free area, which is unexploited, and normally divided by the lift 105 into an upper and a lower section, 106a and 106b, respectively. At the extreme edges of the complete data field, one of the sections, 106a or 106b, decreases to a zero area.

The displayed data can be controlled in relatively small increments by using the arrow boxes. In this example, the complete data field comprises 50 text lines, while only 13 lines, 19 to 31 in the exemplary display, are contained in the normal field of view. By clicking on the arrow box 103, the viewed data is shifted up within the area of the normal field of view 101 by an increment, which is equivalent to a single line, after which lines 18 to 30 are displayed. Similarly, by clicking on the arrow box 104, the viewed data is shifted down within the area of the normal field of view 101 by an increment, which is equivalent to a single line. Therefore, lines 20 to 30 are displayed.

The displayed data can be controlled in larger increments by clicking on sections 106a and/or 106b. Upon each clicking operation on one of these sections, the viewed data is shifted by one "page", which is equivalent to the maximal number of lines that can be displayed in a normal view. In this example, by clicking on section 106a, the viewed data is shifted up within the area of the normal field of view 101 by an increment, which is equivalent to a single page. Therefore, lines 6 to 18 are displayed. Similarly, by clicking on section 106b, the viewed data is shifted down within the area of the normal field of view 101, by an increment, which is

equivalent to a single page. Therefore, lines 32 to 44 are displayed. Of course, similar properties are relevant to a horizontal scroll-bar, which is used to control the data rendered in the normal field of view 101 in the right and/or left directions.

Fig. 1B schematically illustrates the relationship between the size of different elements of a vertical scroll-bar and a partial, and/or the complete data field, in a conventional prior art display screen with a vertical scroll bar on its right side. The screen 100 (shown in Fig. 1A above) containing the partial data field, is positioned beside a theoretical (and larger) screen 110, which comprises the complete data (i.e., all the 50 lines of the above example). The proportions between the complete and the partial data fields are represented by the relative lengths of the lift 105, and the total length of the scroll-bar (excluding the area occupied by the arrow boxes, 133 and 104). The length of the lift 105 corresponds to the length of the partial data field. The total length of the scroll-bar (the sum of the lengths of the segments 106a, 106b, and the length of the lift 105) corresponds to the length of the complete data field.

According to a preferred embodiment of the invention, the "free" (unexploited) area of the scroll-bar is used to display a preview of the "hidden" data, which is divided between the sections 106a and 106b of the scroll-bar. Using the free area permits to display additional information to the user, without loosing area in the normal field of view 101. The graphical representation of the preview of the hidden data comprises graphical comparative elements, from which the user obtains different types of information. Such graphical elements may comprise variations of colors, as well as different tints of the same color (including any combination of black and white).

Fig. 6 schematically illustrates the structure of a scroll-bar containing a preview of hidden data, according to a preferred embodiment of the invention. Assuming that the complete data field comprises N elements, $E_1,\ldots,E_N$, (e.g., N text lines in a document edited by a word processor), the normal field of view of the display screen comprises only a portion of the complete data field, which is represented by M elements (M<N). A numeric value (such as a weighted value) A_i (i=1,...,N, wherein $0 \leq A_i \leq 1$) is assigned to each element E_i. The numeric value A_i is used later to determine visual attributes of each element E_i. For example, if the complete data field represents values of a measurement, these values are normalized (i.e., the maximum measured value is equivalent to 1, and the minimal value is equivalent to 0), and the value A_i corresponds to the relative (to the maximum) magnitude of element E_i. These visual attributes may be determined according to any function of the value A_i, such as linear or non-linear function, or even may be discrete. Moreover, these visual attributes may represent any mapping operation of a domain into a range (e.g., higher data values can be mapped into the presentation of an more "esthetic" icon or image). The total length S of the complete data field is also divided into N segments, $S_1,\ldots,S_N$, each of which corresponds to an element E_i (i.e., the length of the element E_i. is S_i).

The free area of the scroll-bar 200 is also divided into N sections, $P_1,\ldots,P_N$ each of which corresponds to a data element E_i in the complete data field $E_1,\ldots,E_N$. The total length L of the free area of the scroll-bar 200 is also divided into N segments, $l_1,\ldots,l_N$, each of which corresponds to a data element E_i. The length of each segment l_i of the scroll-bar 102 is proportional to the length of its corresponding segment S_i of data element E_i and is given by:

$$l_i = L \cdot \frac{S_i}{S}$$

Hence, the division of the free area of the scroll-bar 200 into sections is related to the distribution of data elements in the complete data field.

According to a preferred embodiment of the invention, a visual effect, calculated by using the numeric value A_i, is assigned to each section P_i, and represents the relative attribute (e.g., the relative value, weight or importance) of the data element E_i. For example, the red color may be assigned to the maximum value of the measured data (data element E_3), and the green color may be assigned to the minimum value of the measured data (data element E_{N-3}). Therefore, when rendering the preview, section P_3 in the scroll-bar 102 is colored in red and section P_{N-3} in the scroll-bar 102 is colored in green. The color of all the remaining sections varies between red and green, according to the relative value of each element with respect to a color scale that ranges between red and green. Of course, other visual effects, such as different patterns, may be used to display the preview to the user. In addition, the same color can be used, but with different tints. For example, section P_3 in the scroll-bar 102 can be colored in dark green and section P_{N-3} in the scroll-bar 102 can be colored in bright green. The color of all the remaining sections varies between bright and dark green, according to the relative value of each element with respect to a color scale that ranges between bright and dark green.

Returning now to Fig. 2A, it schematically illustrates the operation of displaying a preview of complete data that is represented by a set of colored bars, by a colored scroll-bar, according to a preferred embodiment of the invention. The display 100 comprises a sub-set of bars, 201*a* to 201*i*, each of which represents data that is characterized by the length of the bar and its particular color. Such representation is disclosed for example in PCT/IL99/00261 of the same applicant hereof, the entire description of

which is incorporated herein by reference. For example, each bar represents the total sales of a different branch of a travel agency during September 1999, while the color of each bar represents the average sales per agent during that month. The color of each bar varies from bright green to dark red, where bright green represents the highest value of sales per agent, and dark red represents the lowest. Therefore, each bar colored in dark red indicates a problem from the aspect of the average sales per agent during in that particular branch in September 1999, although the total sales of that particular branch may be relatively high. Therefore, the color of each bar provides a direct indication of problematic factors.

According to a preferred embodiment of the invention, the free (unexploited) area of the scroll-bar 102 is divided into a set of bars, the number of which equals the total number of bars contained in the complete data set. Hence, the scroll-bar 102 comprises the colors of all data entities (i.e., a preview of the average sales per agent of all branches during the year 1999) which are not currently displayed in the normal view. Therefore, the scroll-bar renders a "summary" of at least one aspect of the remaining "hidden" data portion. In Fig. 2A, the lift 105 is dragged to the upper limit, and therefore, the current displayed data is the sub-set of bars which are currently "covered" by the lift 105. At this position of the lift 105, the contents of the display 100 correspond to the upper most portion of the data (bars 201*a* to 201*i*). The lower section 106b of the free area renders the colors of the bars that correspond to the rest of the data (the "hidden" portion) to the user. The user can easily have an indication of where the problematic points are and can focus on that area, or on any other area of interest. In this example, the problematic area 202 is represented in the scroll-bar 102 by a group of three bars (circled by a solid ellipse) which are relatively close to dark red.

Fig. 2B schematically illustrates the operation of displaying the selection of a particular area of interest from a preview of complete data that is represented by a set of colored bars, according to a preferred embodiment of the invention. The lift 105 is now dragged down by the user and positioned in overlap with the problematic area 202. The display 100 now comprises a new sub-set of bars, 203*a* to 203*c*, which are typically displayed to the user in the center of the screen. The area of interest 204, (also circled in Fig. 2B by a solid ellipse) comprises full information, which is currently displayed to the user (i.e., color and length of each bar of interest). Therefore, by using the presentation of the scroll-bar 102, the user can immediately focus on said area

Fig. 3 schematically illustrates the operation of displaying the selection of a particular area of interest from a preview of complete data that is represented by a set of colored bars, using calendar lift, according to a preferred embodiment of the invention. The calendar lift 301 comprises a frame with dimensions that are similar to those of a regular lift 105, for allowing the user to position the lift within the free area of the scroll-bar. Most of the inner area of the lift 301 is "transparent", and enables the user to fully exploit the free area of the scroll-bar, by rendering a complete preview of the hidden data, independently of the current position of the lift 301. In addition, the user can position the central area of the lift 301 essentially to overlap with the area of interest. This feature enables the user to immediately display the area of interest in the center of the normal display 100, and eliminates the need to navigate within the previewed data. The area of interest (bars 203a to 203c, in Fig. 2B) is represented by three dark red bars in the center of the calendar lift 301.

Fig. 4 schematically illustrates the operation of displaying a preview of minimized data items, contained in the complete data, which are

represented by a set of colored bars, according to a preferred embodiment of the invention. The complete data set in this example is a document 401, edited by a word processor that comprises headlines 402 and 403 in bold colored font, and conventional text lines in normal black font. All the headlines in the document appear as dark or colored bars in the scroll-bar 102. In this example, bars 402a and 402b represent headlines 402 and 403, respectively. This representation enables the user to focus only on the headlines, while skipping lines of regular text. The user can easily and accurately switch between selected headlines, and each time render one or more headlines of interest in the normal view. The document may also comprise images, which also appear in a reduced form in the scroll-bar 102, as colored bars. An example of a reduced or thumbnailed image is shown in Fig. 5. In this example, the image 500 (a rabbit) occupies the whole area of the normal view, and therefore, is represented in the scroll-bar by a bar 501, the length of which is essentially equal to the length of the lift 301. By positioning the lift to essentially overlap with the bar 501 (i.e., with the thumbnailed image), the image 500 is brought into the center of the normal view and fully displayed to the user.

According to a preferred embodiment of the invention, the scroll-bar can be used as a preview of a sequence of images, each of which is represented by a bar having a corresponding length. Since each bar is a reduced actual image, the main properties of each reduced image are represented in the preview, and therefore can be easily recognized and selected by the user, without the need to search or browse the complete data. Such properties may comprise, for example, colors, patterns, contrast, and any combination of them.

According to another preferred embodiment of the invention, a preview of aggregated data is provided by the scroll-bar. Such aggregated data may

be, for example, an electrocardiogram plot of the heart activity of a patient. Since the length of the complete plot increases with time, the preview rendered in the scroll-bar is continuously "compressed", while enabling the user to select any particular area in the plot and immediately display it in a normal view, by simply "dragging" the lift 301 to overlap with that particular area.

According to another preferred embodiment of the invention, the user can immediately and accurately display a selected area from the preview of the hidden data, by simply pointing on a particular bar that represents the data of interest (e.g., an image) with his mouse pointer, and click on that particular bar. This operation can be selected, instead of dragging the frame of the lift 301 to overlap with the area that contains that particular bar.

According to another preferred embodiment of the invention, a combination of vertical and horizontal scroll-bars is used to represent two dimensional data, such as a table that is used to represent data in a spreadsheet (e.g., Microsoft Excel™). The vertical scroll-bar represents columns, while the horizontal scroll-bar represents rows. Each scroll-bar represents a preview of all the rows or all the columns, and the user can easily obtain a view that shows which rows or columns contain data. The user can skip empty rows and/or columns, and immediately reach areas which contain data of interest. Furthermore, such representation allows to map the data values by assigning a color (e.g., a red color) to higher values, and assigning a different color (e.g., a green color) to lower values.

The above examples and description have of course been provided only for the purpose of illustration, and are not intended to limit the invention in any way. As will be appreciated by the skilled person, the invention can be

carried out in a great variety of ways, employing more than one technique from those described above, all without exceeding the scope of the invention.

CLAIMS

1. A method for graphically rendering a preview of a complete set of data to a user, in parallel with a normal view of at least a portion of said data, within the area of a scroll-bar, comprising:

a) dividing the data field of said complete set of data into N (N=1,2,...) slices;

b) dividing the length of the free area of said scroll-bar into N corresponding segments;

c) determining the length of each segment according to one or more particular attributes of its corresponding slice;

d) determining the length of the lift of said scroll-bar to represent the data portion being displayed in a normal view;

e) modifying the graphical representation of each segment by assigning a particular visual characteristic to each segment, said characteristic representing said one or more particular attributes;

f) generating a preview of the remaining portion of said data by displaying each of said N modified segments in said scroll-bar.

2. A method according to claim 1, further comprising enabling the user to vary the content of the normal view by changing the relative position of the lift within the scroll-bar.

3. A method according to claim 1, wherein the length of each segment is proportional to the ratio between the length of its corresponding slice, and the total length of the complete set of data.

4. A method according to claim 1, wherein the particular attribute is a relative value represented by the slice, with respect to an extreme value of another slice.

5. A method according to claim 1, wherein the particular attribute is the color of the slice.

6. A method according to claim 1, wherein the particular attribute is the tint of the slice.

7. A method according to claim 1, wherein the particular attribute is the pattern of the slice.

8. A method according to claim 1, wherein the particular attribute of the slice is any combination of its pattern, color or tint.

9. A method according to claim 1, wherein the particular attribute of the slice is a predetermined mapping operation.

10. A method according to claim 1, wherein the particular visual characteristic is the color of the segment.

11. A method according to claim 1, wherein the particular visual characteristic is the tint of the segment.

12. A method according to claim 1, wherein the particular visual characteristic is the pattern of the segment.

13. A method according to claim 1, wherein the particular visual characteristic of the segment is any combination of its pattern, color or tint.

14. A method according to claim 1, wherein each slice represents a minimized or thumbnailed image.

15. A method according to claim 1, further comprising continuously updating the number and/or the length and/or the graphical representation of each segment in the scroll-bar, in response to the addition of data into the existing set of data.

16. A method according to claim 2, wherein a data segment is selected from the scroll-bar for display in proximity of the center of the normal view, according to the degree of overlapping between the center of the lift and said segment.

17. A method according to claim 1 or 2, wherein a data segment is selected by the user from the scroll-bar for display in proximity of the center of the normal view, by pointing on said data segment, and clicking a mouse button, or pressing a key in the keyboard associated with the data processing and/or display apparatus.

18. A method according to claim 1, wherein the lift comprises a transparent area, through which the previewed data-portion is continuously displayed in any lift position.

19. A method for graphically rendering a preview of a complete set of data to a user, substantially as described and illustrated.

20. A scroll-bar for use with a data processing and/or displaying program, characterized in that it is divided into N segments, corresponding to N slices of a data field associated with said program, each of said segments

being dynamically modifiable in its graphical representation according to one or more particular attribute of said slices.

21. A scroll-bar as claimed in claim 20, which is a vertical scroll-bar.

22. A scroll-bar as claimed in claim 20, which is a horizontal scroll-bar.

23. A display view, comprising a scroll-bar as claimed in any one of claims 20 to 22.

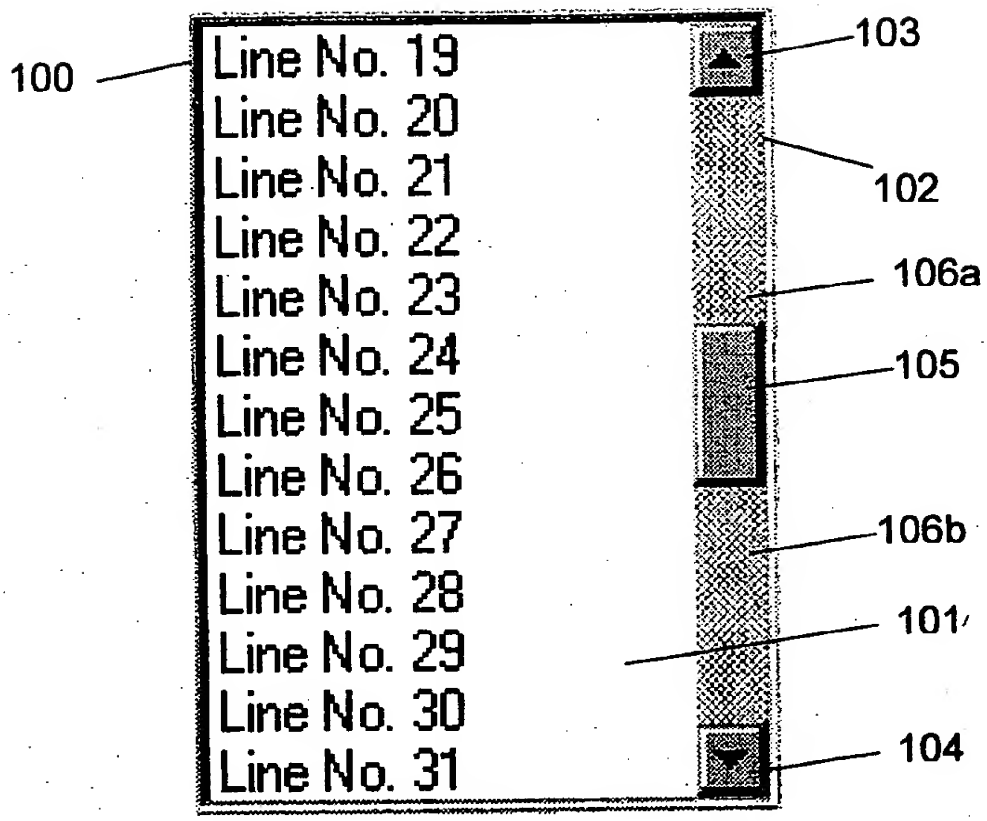


Fig. 1A (Prior art)

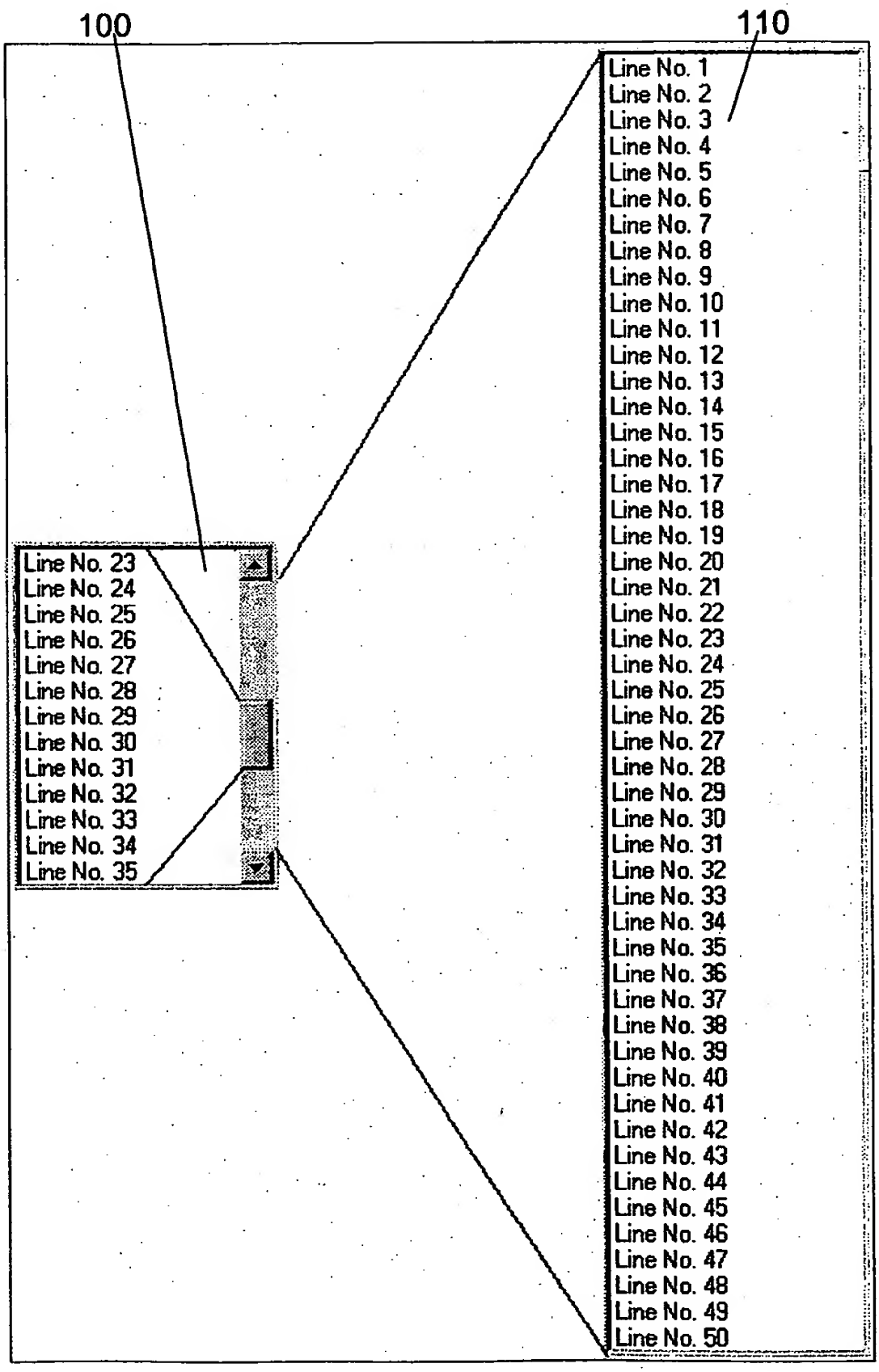


Fig. 1B (Prior art)

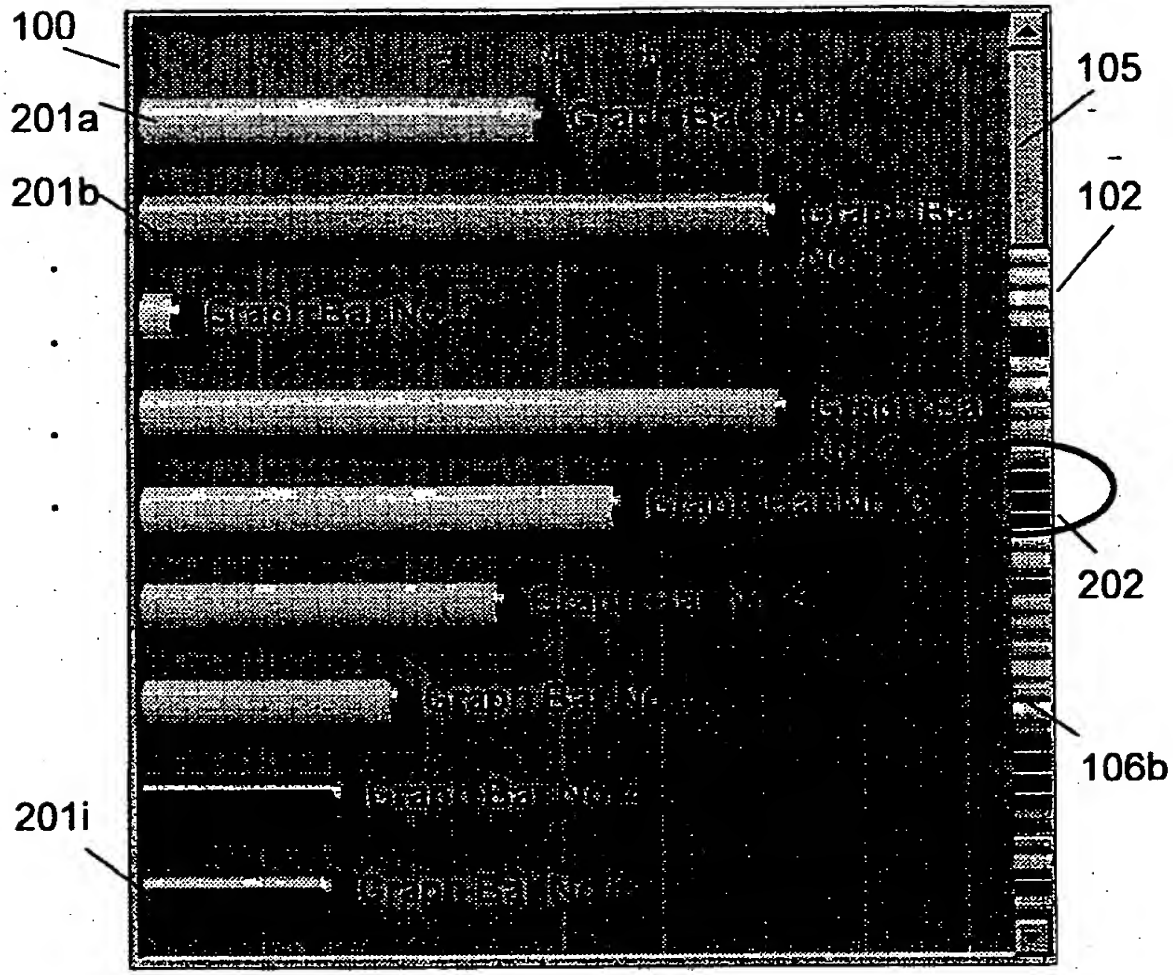


Fig. 2A

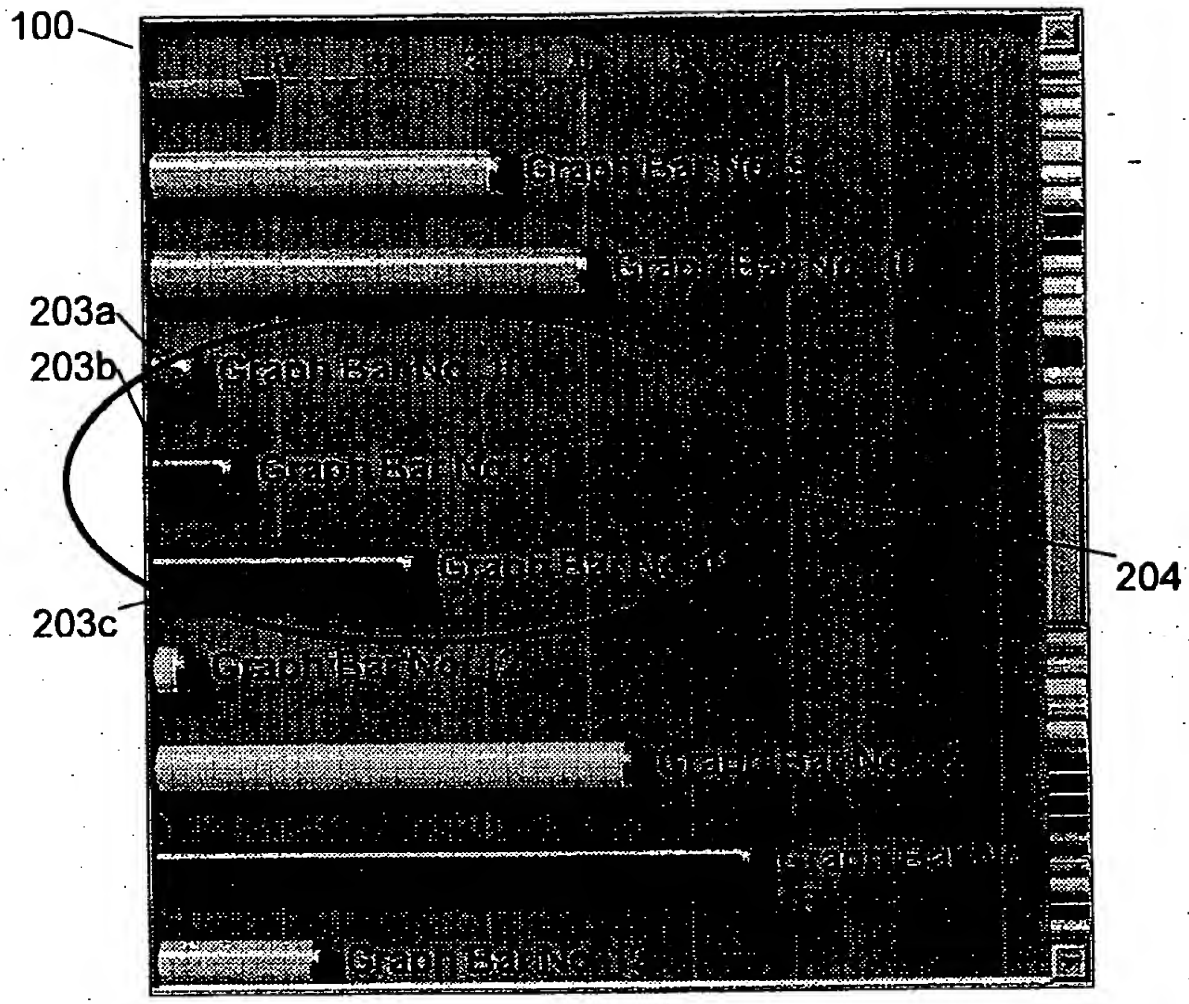


Fig. 2B

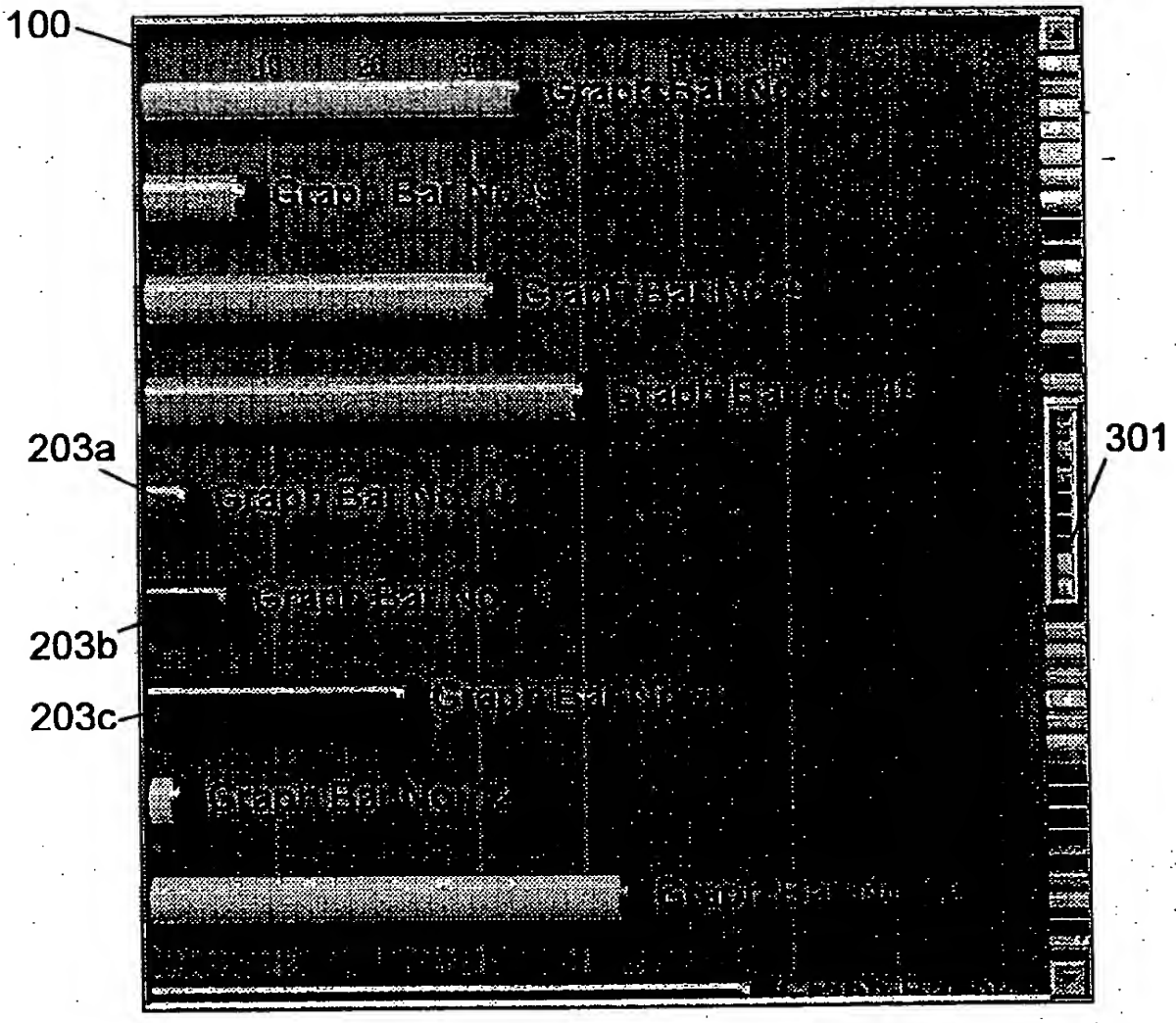
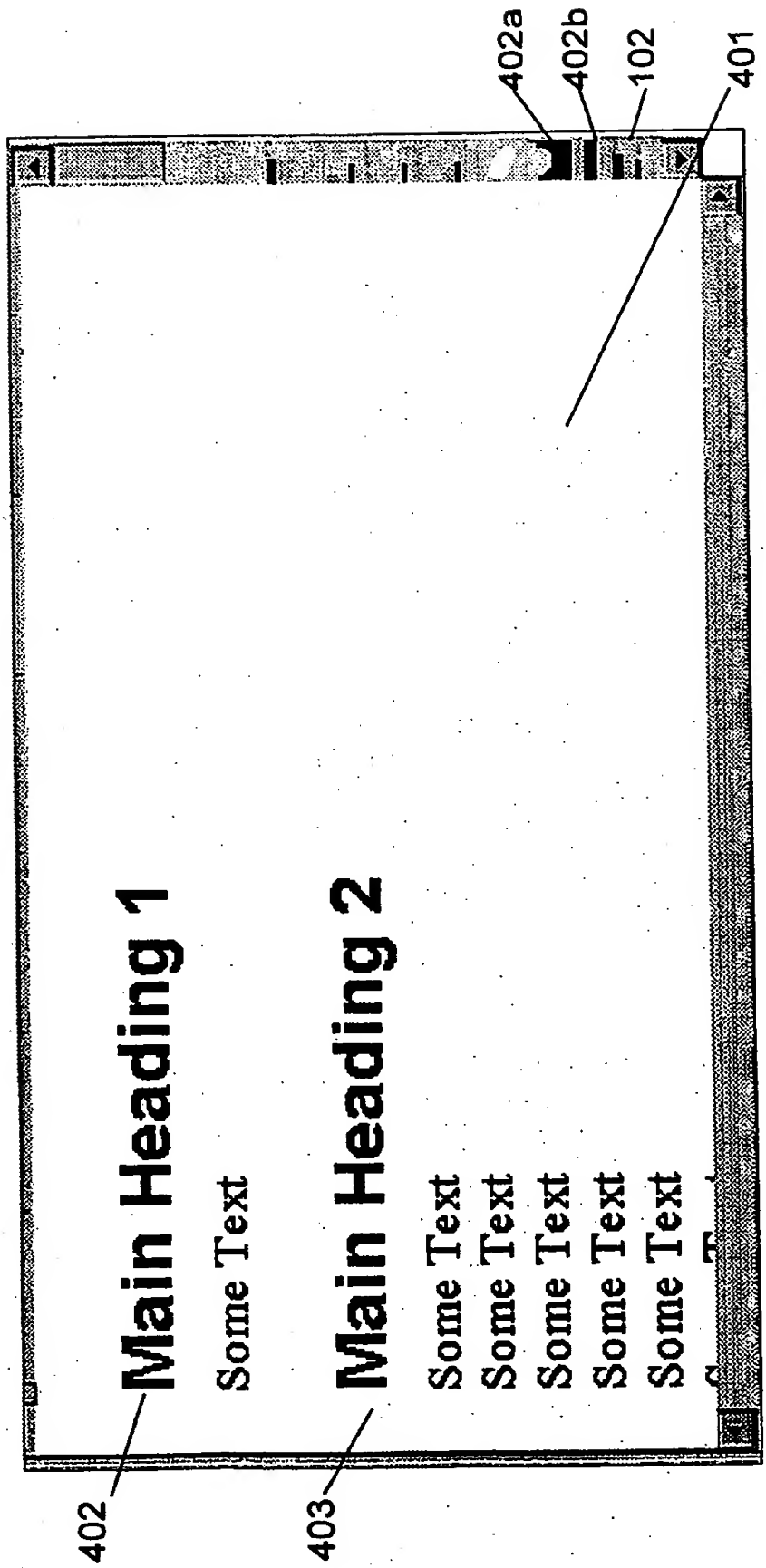


Fig. 3


402a
402b
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401
Main Heading 1
Some Text
Main Heading 2
Some Text
Some Text
Some Text
Some Text
Some Text
402
403

Fig. 4

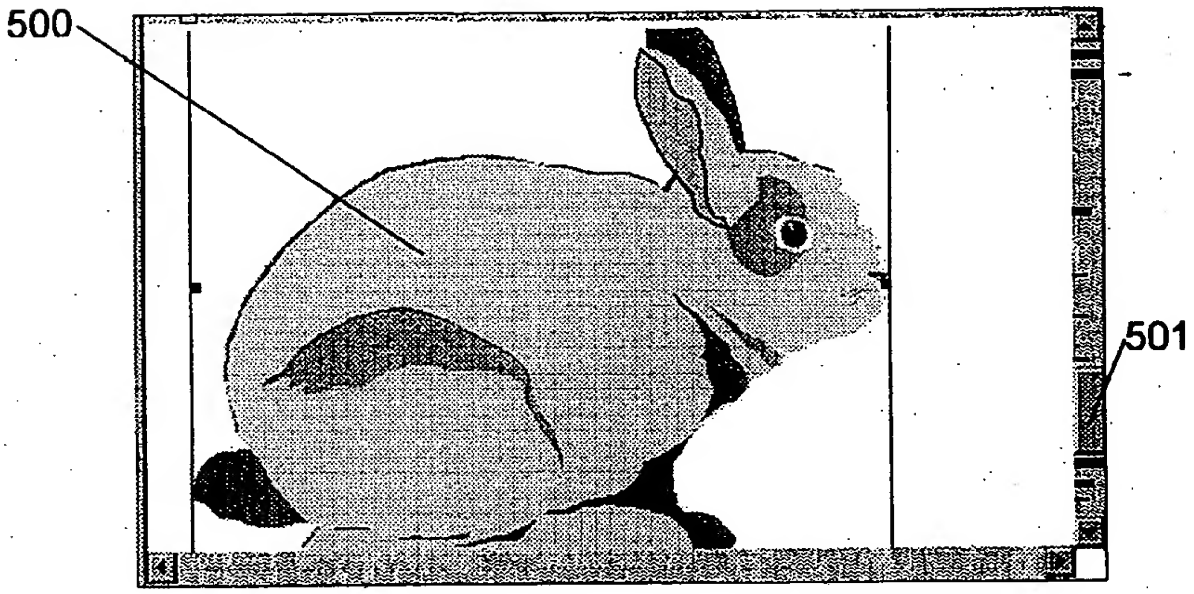
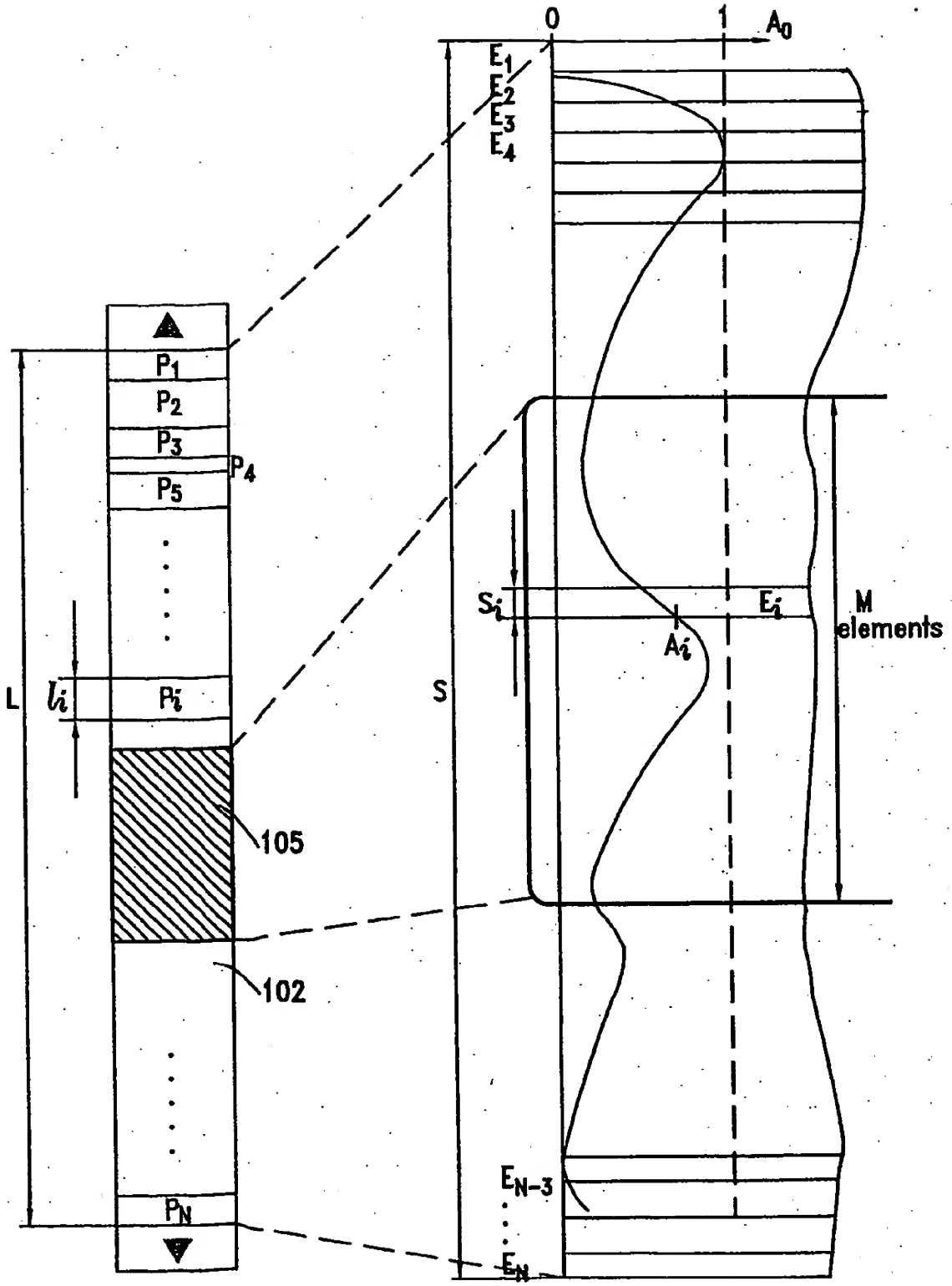


Fig. 5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A_0
E_1
E_2
E_3
E_4
P_1
P_2
P_3
P_4
P_5
P_i
l_i
L
S
S_i
E_i
A_i
M elements
105
102
P_N
E_{N-3}
E_N

Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 99/00515

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F3/033

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 509 160 A (IBM) 21 October 1992 (1992-10-21) abstract column 4, line 20 -column 6, line 12; figures 5-9	1-3, 17-23
Y		9-13
X	PATENT ABSTRACTS OF JAPAN vol. 018, no. 070 (P-1687), 4 February 1994 (1994-02-04) & JP 05 282255 A (TOSHIBA CORP), 29 October 1993 (1993-10-29) abstract & JP 05 282255 A (TOSHIBA CORP) 19 October 1993 (1993-10-19) figures 2,5,7	1-3,17, 19

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 January 2000	02/02/2000

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IL 99/00515

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	"SHADING AS A FREQUENCY INDICATOR" IBM TECHNICAL DISCLOSURE BULLETIN,US,IBM CORP. NEW YORK, vol. 37, no. 1, January 1994 (1994-01), page 527 XP000428872 ISSN: 0018-8689 the whole document	9-13
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International Application No
PCT/IL 99/00515

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